In sight and in Mind: Does Increasing the Salience of the Limitations of Safety Equipment Reduce Risk Taking Behaviour?

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Contents

Abstract

Unwanted risk taking behaviour is something which weighs heavily on society, and yet high accident rates resulting from risk taking behaviour would indicate that existing preventative measures leave room for improvement. The present experiment approached risk taking behaviour in the context of Risk Homeostasis theory (RHT), in order to examine whether increasing the salience of the limitations of safety equipment would decrease the risk taking behaviour associated with RHT. 46 participants from the University of Canterbury student body were randomly assigned to one of two conditions, the control and the "high-salience" participant pool and asked to climb a rock climbing wall twice, using a belaying system and harness. In the high-salience pool, participants were exposed to a small warning label attached to their harness which had to be removed to don the safety equipment. The label was marked with the warning intended to increase the salience of the safety equipment's limitations. The time taken to complete each of the two climbs, as well as the number of times each participant slipped or fell whilst climbing was recorded. These were used to measure risk taking during the climb. All participants were also given a nine-question questionnaire which measured their perceived enjoyableness of the activity. It was hypothesised that increasing the salience of the limitations of safety equipment would decrease the risk taking behaviour associated with Risk Homeostasis theory. It was further hypothesised that the salience of the limitations of safety equipment would not negatively affect participant perceptions of activity enjoyability. Analysis of the resulting data supported the study hypotheses, and found that there were statistically significant between group differences associated with increasing the salience of safety equipment limitations on risk taking behaviour. It was also found that this increase in salience had no statistically significant influence on perceived enjoyableness.

Introduction

<u>1. Introduction Overview</u>

Calculating risk, risk taking behaviour and decision making are omnipresent in almost every aspect of daily life. The consequences of these choices can be both positive and negative, both miniscule and immense; from choosing to forgo a cup holder and spilling coffee as a result to the serious injury or death associated with choosing to drive at elevated speeds (Stella et al., 2002). Unwanted risk-taking behaviour has a particularly heavy impact in industrial settings when individuals choose to eschew personal protective equipment or violate health and safety procedures (Colquitt et al., 2007). The ramifications of these violations result not only in personal harm on the part off the violators and their colleagues (Olson et al., 2009) but possible financial and legislative consequences for their employers (Miller & Blewden, 2001). The reach of unwanted risk-taking behaviour extends beyond industrial settings and into day to day life resulting in everything from antisocial behaviours such as theft and bullying (Liang et al., 2007) to dangerous sexual practices and gambling (Santor et al., 2000; Martins et al., 2004). With the negative influence of unwanted risk-taking behaviour so vast, there is much to gained from exploring means to moderate and ameliorate this behaviour. In lieu of this, research into examining risk taking behaviour is extensive (Janssen & Tenkink, 1988), with the social motivations such as approval seeking (Chein et al., 2010), industrial motivations such as time-spent-to-value-gained trade-offs (Tam et al., 2002) and personal reasons such as thrill seeking (Lyng, 1990) all well documented and researched. However, the cognitive mechanism which underpins the way in which individuals construct their perceptions of risk and attribute value to risk versus payoff is less when documented and largely relegated to the taxonomy of the phenomena rather than means of intercepting it (Wilde, 1982).

One of the prevailing taxonomic theories put forward in an attempt to define risk perception is Risk Homeostasis theory (RHT) (Wilde, 1982). RHT purports that all individuals have a level of risk at which they are comfortable. Depending on this baseline, they will behave more or less dangerously depending on how high in risk they perceive a situation to be, in order to return to that median (Wilde, 1987). With RHT as the theoretical context, the present experiment examines a means of moderating risk-taking behaviour by manipulating individual perceptions of risk in a given situation. This approach has been selected instead of more common wide spread behavioural interventions which focus heavily on creating safety positive environments (Sawacha et al., 1999; McFadden et al., 2009).

The present experiment was designed to modify the perceived level of risk involved in a rock climbing task by increasing the salience of the limitations of the individual's safety equipment through use of signage; in this case a luggage tag tied to the Participant's harness which had to be removed for the harness to be put on. The label contained the warning "This harness is intended to protect the user from serious injury or harm, however the risk of serious injury or harm is not eliminated by use of the harness". This was implemented as a possible option for supplementing existing health and safety protocols in a non-invasive and cost-effective manner.

2. Risk as a Behaviour and its Impact

Almost every choice and interaction in day to day life contains an element of risk. These risks can be positive, benign or negative in their consequences depending on how well the risk was calculated, as well as the environment in which the risk is carried out. For example, there is an element of risk in choosing to get in a car and drive to work in the morning, however the benefits of being employed and having an income outweigh the risk involved in driving. Bungee jumping offers a thrill to adrenaline seekers, and whilst the ramifications if a jump were to go wrong are catastrophic, the probability of this happening is small enough that thousands of individuals take the plunge every year. However, risk taking behaviour when miscalculated can have enormous personal and wider social impacts. In New Zealand between the years 2000 and 2012, 125,997 individuals were fatally or severely injured in accidents (ACC, 2015). When this figure is scaled for the population size of New Zealand it means approximately 1/36 New Zealanders have been severely injured or killed in accidents in this time frame. An estimated one in 90 incidents of driving whilst intoxicated end in a crash in New Zealand and the overall cost to the economy is estimated to be in excess of 1.2 billion (Miller & Blewden, 2001). Antisocial behaviours, such as theft, drug use and violent crime can all be broken down to inappropriate or undesirable risk analysis or overt risk seeking (Zuckerman & Kuhlman, 2000). In commercial settings, risk-taking behaviour, this being the eschewing of personal protective equipment or disregarding health and safety protocols, can have considerable financial and legislative implications.

Despite the immense impact of unwanted risk-taking behaviours, the scope of research into preventing it is limited. Analysis of the cognitive mechanisms underpinning risk taking remains largely taxonomic (Wilde, 1982), or focuses on design (Reason, 1997), education (Burke et al., 2006), and fines (Health and Safety at Work Act, 2015), based preventative measures, rather than addressing the decision-making process before engaging in risk taking (Wilde, 1982). These limitations can be largely due to practical limitations, such as the incredibly diverse and varied individual differences in cognitive processing of risk from situation to situation, and ethical restrictions in exposing participants to danger during experiments. Despite this, examining behavioural means to intercept risk-taking behaviour has an important part to play in reducing unwanted behaviours. This is because whilst the success of other means of intervention is well evidenced (Sawacha et al., 1999; Flin, 2003; Cavazza & Serpe 2009) high incidents of high cost accidents as a result of violation based risk taking are still high (Miller & Blewden, 2001) and still imposing a high societal toll which would indicate room for improvement or at least supplementation of existing protocols.

3. Social Risk-Taking Behaviour

In social situations whilst the time/efficiency trade off previously mentioned is still very much present, there are two other influencers which play a pivotal role in influencing the perceived value of risk taking for an individual; these being social pressure and adrenaline seeking behaviour, the two of which are often closely intertwined. Research by Gardner and Steinberg (2005) examined 306 participants in terms of their risk aversion in both social and isolated settings. Using a survey based measure, Gardner and Steinberg (2005) found that whilst the inclination of participants to show preference towards risk taking behaviour decreased with age, all age brackets displayed a decrease in risk-aversion when completing the survey surrounded by their peers. Santor et al., (2000) surveyed students for measures of conformity seeking, approval seeking and popularity. These results were contextualised it in terms of the student's attitudes towards high risk behaviours such as dangerous sexual practices, poor school performance and substance abuse (Santor et al., 2000). This research found that students who measured as being higher in seeking peer conformity, popularity seeking and approval seeking behaviours, were also measured higher in displaying high risk behaviours. Research by Chein et al., (2010) found that in adolescents, risk taking behaviour can be perceived as more attractive because the parts of their brain responsible for identification of reward, primarily the ventral striatum and orbitofrontal cortex are more engaged when the approval of peers is part of a risk analysis as opposed to when it is not. Moreover, the parts of the brain responsible for inhibiting behaviours were less actively engaged in these situations by the adolescents than their adult peers Chein et al., 2010).

Although adolescents are more predisposed to risk taking for social approval the behaviour is also exhibited in adults (Chein et al., 2010). Moreover, the perceived rewards as a consequence of risk taking behaviours are not limited to social reinforcers. Weber et al., (2002) defines risk taking as something which can be broken into 6 domains; gambling, investing, health and safety, socialising and recreation. Weber et al., (2002) argues that risk taking is domain specific for each individual, with acceptable levels of risk fluctuating across domains. However, the common denominator across domains is that there is a perceived level of risk and a perceived pay off which will result (or in the case of gambling will possibly result) from the risk-taking behaviour (Figner & Weber, 2012) in the eyes of the participant. It is in the way that the individuals view the possible risk and the possible pay of that the propensity for risk taking manifests across settings from social to industrial (Figner & Weber, 2012).

4. Existing Environment in Industrial Settings

4a. The Importance of Shared Responsibility and Inclusive Design

The Health and Safety at work Act, brought into effect in New Zealand in 2015 includes numerous amendments to the existing legislature intended to both distribute responsibility down the supply chain and encourage pro-safety behaviours in industrial settings (Health and Safety at Work Act, 2015). These implementations include requiring transparent, comprehensive and easy to understand health and safety protocols to be easily available for all staff, requiring inclusive Health and Safety review processes and implementing an “up-stream obligation” for contractors to proactively manage the health and safety of their suppliers (Health and Safety at Work Act, 2015). This emphasis on involving all staff in Health and Safety protocols and creating accessible protective systems is an approach supported by imperial evidence. Take for example procedures examined in research by the likes of McFadden et al., (2009) which explored the relationship between spreading responsibility for health and safety culture throughout the management ladder in hospitals, and patient safety. McFadden et al., (2009) reviewed the health and safety management system of 212 American hospitals, with particular emphasis on how responsibility for health and safety was spread down the management chain. It was found that organisations which consistently achieved low error performance, even in high risk operations also showed a strong trend towards having well distributed health and safety systems. Moreover, it was found that charismatic, proactive and relatable leadership, referred to as Transformative Leadership (TFL) has a strong correlation with low accident rates for staff and thus over all better patient safety (McFadden et al., 2009). That is to say, there was a strong statistical correlation ($p<.001$) between having inclusive, proactive leadership which was engaged with health and safety culture and being a High Reliability Organisation (HRO); in this instance a HRO is defined as an organisation which has low accident rates across environments when compared to the industry standard (McFadden et al., 2009). In this analysis leadership engagement was measured in a broad spectrum of ways. However, particular emphasis was placed on examining pro-safety environments being promoted through open safety forums, proactive implementation and consideration of safety suggestions and management involvement in safety initiatives (McFadden et al., 2009). The safety and compliance of other industries appear to also benefit from the influence of pro-safety behaviours being well distributed through the supply chain, as is enforced by the Health and Safety Act (2015).

Further review of the importance of wide spread organisational involvement was carried out by Sawacha et al., (1999), reviewing 120 organisations across the United Kingdom. Sawacha et al., utilised a survey based analysis of health and safety attitudes and compared this to actual empirical health and safety performance by each correspondent's business. Using their injury history, the companies were ranked on a scale of 1-3 for their safety performance, with 3 being those with the least incidence of harm or violations and 1 being those with the most. Analysis of the correlation between these two factors indicated that five key attitudinal factors were the most heavily associated with high health and safety performance; these being management talk on health and safety, provision on health and safety booklets, provision of safety equipment, providing a safety focused environment and appointing trained safety representatives on site (Sawacha et al., 1999). These findings in conjunction with other research into the importance of inclusion and spread of responsibility for health and safety (Tam, 2004; Burke et al., 2006; Sawacha et al., 1999; Simard & Marchand, 1994) indicate that there is indeed empirical evidence supporting the approaches to health and safety enforced by New Zealand health and safety legislature. Moreover, research indicates that there is an awareness within industries that the involvement of management and dispersal of responsibility along the supply chain is important.

Research by Tam et al., (2004) examined safety behaviours in the construction industry in Hong Kong, a municipality of China with a historically poor record of industrial safety (Tam et al., 2004). In this research 200 construction companies in Hong Kong were sent a questionnaire examining five aspects of their health and safety; their health and safety management systems, safety behaviours and measures, impact of site accidents on companies, factors affecting safety management, and government support received (Tam et al., 2004). Of the 200 construction companies contacted 60 responded, predominately those which were state owned, making up 87% of responses. In spite of the fact that the companies which were reviewed selected themselves for participation poor safety awareness of the firm’s top leaders, lack of training, reluctance to allocate resources to health and safety and reckless operations were reported as the primary barrier impeding more effective health and safety measures (Tam et al., 2004). The findings of Tam et all., (2004) can be viewed as an extrapolation of the findings of the likes of Sawacha et al., (1999) in that even in parts of the world with poor performance in health and safety, there is an awareness that management involvement is essential. However, despite this knowledge within high risk industries there is a dissonance between what workers are aware needs to happen and the inclination of staff and businesses to comply (Lieu et al., 2015). This dissonance is fed by a myriad of factors, including economic, social and practical (Tam et al., 2004; Dingsdag et al., 2008) and is one of the barriers preventing legislative measures from being as effective as they might otherwise be.

4b. Workplace Pressures

The importance of integration and spread as well as the apparent awareness of its importance is well documented (McFadden et al., 2009). Be this as it may, accident rates would indicate that as theoretically valid as provisions within legislature may be, there are barriers impeding the efficacy of legislative intent. These pressures can be social for example, social approval seeking or the avoidance of colleague chastisement (Dingsdag et al., 2008), economic (Lind, 2008), with staff and management trading safety for speed of process (Lieu et al., 2015), and practical, with efficiency and ease of process when perceptions of risk are low also coming into play (Ganczak and Szych, 2007). All of these factors combine to dilute positive environmental health and safety influences and increase risk taking behaviour.

Industrial fields, such as construction or heavy metal work are some of the fields at the highest risk for severe workplace injuries, with up to three times the fatal accident rates of other industries (Kisner & Fosbroke, 1994). Despite the risk associated with industrial occupations, the industry’s relationship with health and safety protocols has traditionally been *be grudging* at best, and at worst, *overtly disdainful* as found by Cavazza & Serpe (2009). Cavazza and Serpe (2009) examined the extent to which three key indicators of staff and company attitudes towards personal protective equipment (PPE) correlated with staff ambivalence and non-compliance with PPE. Cavazza and Serpe (2009) found that construction workers in an environment which ranked highly on company safety concern, senior managers' safety concern, supervisors' attitudes towards safety in turn had staff whom were less ambivalent towards PPE and also less likely to commit unsafe behaviours such as misusing or working without PPE. Inversely, ambivalence towards PPE increased when work pressure, i.e. pressure to complete a job rapidly, increased.

The phenomenon of work, and particularly time pressures, having a negative impact on worker attitudes towards organisational health and safety (OHS) has been observed consistently across both the wider industrial field, and across numerous international locations. In an analysis of Chinese construction workers, Liu et al., (2015) found a significant correlation between a positive safety environments and reduced injury. Further, it was found that when management staff prioritised work volume, injury rates increased (Liu et al, 2015). Research by Dingsdag et al., (2008) examined trade workers self-reported reasons for eschewing PPE, or deviating from local OHS laws in Australia. Dingsdag et al., (2008) found that once again, how positively OHS was construed in the industrial environment was a key influence in how willing the participants were to use PPE, and comply with the OHS legislature. This apparent time-to-convenience PPE trade-off, as well as the influence of their environment in affecting a worker's attitudes towards OHS procedures, also pervades other industries and environments, such as the medical field (McFadden et al., 2009).

An observational and survey based study into risk taking behaviour in the medical field by Ganczak and Szych (2007) found that when medical staff perceive the risk of contracting a blood born pathogen as being low, such as when dealing with a patient they perceive to be outside of the demographic they consider to be at risk for blood born disease, they are less likely to use PPE such as gloves or a mask. This trend prevails even when the patients' medical history is unclear Ganczak and Szych (2007).

4c. Repercussions and Enforcement

The industrial health and safety environment as currently illustrated presents two opposing forces acting on individuals in the workforce; on one hand, you have legislative and in some circumstances organisational pressures pushing safety measures which have been empirically proven to improve safety performance. On the other, you have environmental pressures such as perceived effort expended to value gained trade-offs, risk perceptions and social pressure all pulling an individual towards possible non-compliance. In circumstances when a business (defined as a Person Conducting a Business or Undertaking, PCBU) does not comply with the legislature intervention from government and enforcement organisations is largely warning, fine and prosecution based (Health and Safety at Work Act, 2015). For example, under the Health and Safety Act at Work Act 2015 the penalty for a worker recklessly exposing an individual to a risk of serious injury, illness or death can result in prosecution and up to 5 years in prison or up to a $300,000 fine. If a PCBU (for example the management team of a business) are found to be committing the same violation they can be fined up to $3 million. Failure to advise the appropriate authorities of a ‘notifiable event’, for example injury requiring medical attention, is a $10,000 fine for the individual and up to $50,000 for a PCBU (WorkSafe New Zealand, 2018). These heavy financial penalties for both worker and business may, at first glance, seem like a powerful deterrent for non-compliance. Indeed, research into the efficacy of harsher financial penalties when compared to lesser penalties does indicate that harsher penalties have lower rates of recidivism in the case of speeding fines (Goncalves & Mello, 2017). Goncalves & Mello (2017) found that individuals with lesser fines for speeding (allocated when individuals exceed the speed limit by 9 miles per hour or less) are 25% more likely to have a second speeding ticket in the 12-month period following the fine, when compared to individuals exceeding the limit in a higher fine bracket. Furthermore, Simpson and Schell (2009) found that Occupational Health and Safety (OHS) inspections do indeed have an inhibitory effect in the long term with regards to preventing OSH rule violation recidivism. However, whilst there is research into the efficacy of fines and interventions on recidivism, there is little to no readily available, quantitative research into how effective these measures are in preventing the behaviour from happening in the first instance with regard to Health and Safety code violations. This brings to bare the question; with accident and injury rates as high as they are globally (Quinlan et al., 2001) are the looming threats of fines and prosecution effective enough means of encouraging pro-safety behaviours?

Whilst there is somewhat of a vacuum in the research as to the efficacy of the threat of financial penalties in preventing first time OHS violations, research into the prevention of other unwanted risk-taking behaviour can be borrowed to review the best means of preventing unwanted risk-taking behaviour on a wide scale. Research into preventing smoking is one such field. Goldman & Glantz, (1999) conducted 186 focus groups, involving 1500 adults and youths, reviewing 118 anti-smoking advertisements spreading across a wide scope of approaches. The categories of advertisement include those which attempting to manipulate perception of the industry, emphasising the impact on others (second hand smoking), emphasising the measures taken by tobacco companies to encourage addiction, encouraging quitting, highlighting the short-term effects of smoke, highlighting the long-term effects of smoking and finally constructing smoking as a behaviour which will lead to romantic rejection (Goldman & Glantz., 1999). This research found that emphasising the short and long-term effects of smoking and possible romantic rejection were not effective means of preventing or reducing tobacco consumption. Instead denormalization of smoking in the form of industry manipulation and highlighting the effect of second hand smoke on others were deigned as being the most effective means of discouraging smoking (Goldman &

Glantz, 1999). In this context “industry manipulation” was defined as measures which took away from the cool, glamourous image of smokers portrayed in the media. Further research by Pechmann et al., (2003) which similarly review the influence of several different varieties of message. Once again, Pechmann et al., found that emphasising negative future ramifications for the individual were not effective means of discouraging smoking behaviour. As with the research by Goldman & Glantz, (1999) the most effective means of preventing smoking were found to be emphasising the negative implications for others, specifically through the effects of second hand smoking, and also through highlighting current negative life circumstances of smokers (Pechmann et al., 2003). This finding is reflected across research in the industry (Zhao & Pechmann, 2007) and when applied to OHS, this approach highlights the fact that perhaps fine and prosecution based deterrents align more closely with health-ramification based preventative initiatives in smoking, which have been found to be ineffective. That is to say, there is a possibility that the discrepancy between the apparent efficacy of integrated and inclusive health and safety measures and the current high rates of accidents, may not be because the OHS protocols are ineffective. Instead it may be because preventative measures which rely on emphasising negative future outcomes for an individual may not be the most effective way of discouraging violations. This in turn could allow the pull of environmental factors which encourage non-compliance coming to outweigh the influence of positive health and safety practices.

With an overview of the circumstances and environments which surround risk taking in wider sense in mind, one can then begin to contextualise the cognitive mechanisms which facilitate the behaviour in the first instance. This is essential when considering a means to prevent unwanted risk taking on a wider scale; because whilst the circumstances in which risk can occur are infinitely diverse, cognitive processes remain relatively constant and thus are more easily isolated, defined and intercepted.

5. Taxonomy of Risk-Taking and Present Research

It is clear that across settings and demographics the weight individuals assign to the possible consequences of a risk they are taking, before they take it, is an essential factor in dictating their actions (Zuckerman& Kuhlman, 2000). What individuals assign value to in these circumstances (for example efficiency or social approval) is relatively clear, however the processes underpinning how they weight these factors is less widely agreed on, and more contentious in the field of cognitive engineering (Wilde, 1982).

One of the theories put forward to describe the way in which individuals assess a situation, and in turn what an appropriate behaviour is given the perceived risk level, is Risk Homeostasis Theory (Wilde, 1989). Risk homeostasis theory describes a process through in which individuals behave in a more or less dangerous manner depending on the level of risk they perceive as being present in an environment. Wilde (1982) further purports that everyone has a baseline level of risk at which they are comfortable, and that their behaviour in each situation is an attempt to return themselves to this baseline level of risk. There are a myriad of environmental factors which modify the perceived level of risk, and also the value that individuals attribute to both the risk and the outcome; these include the afore mention social approval, time-risk trade-offs, skill levels, familiarity with the task at hand, and the level of safety equipment available. Wilde (1982) argues that in any situation an individual's primary goal is to return to a baseline level of risk at which they are comfortable. Take, for example, an individual who is driving a car around a race track. If the individual has extensive PPE, such as a neck brace, helmet and fire-retardant suit they may be more inclined to drive fast, corner more sharply and break more rapidly than if they did not. In turn, a more risk adverse individual in the same situation could be expected to take less risks, even with the same safety equipment, as their personal threshold for risk is lower than that of the previous individual. Wilde (1987), both the founder and one of the greatest proponents of RHT, argues that RHT explains how individual preferences for risk vary from situation to situation, but maintain consistency for the individual on a personal level. For example, take a new driver, when they first get behind the wheel of a car they may be more cautious than other individuals on the road. RHT would purport that this is not because the individual is comfortable with less risk than they would be in another situation, but instead that said individual is accounting for their own low level of skill and behaving more carefully to return to the baseline level of risk at which they are comfortable. This also accounts for the fact that as skill levels increase, individuals are more inclined to take risk as they perceive their skill levels as being able to compensate for environmental factors.

However, there are those that dispute the claim that RHT is the most effective means of describing risk based decision making (e.g., Adams, 1987; O'Neil & Williams, 1998). Evans (1986) argues that a shortcoming of RHT is that it does not explain the fact that accident rates do not remain static when new safety laws or protocols are put into effect. This is to say, Evans (1986) argues that if RHT were truly in effect then individuals would simply compensate for the new safety precautions by taking more risks, thus rendering their effects null and void. A preliminary look at research on motor vehicle accident rates both before and after safety protocols are changed would initially appear to support Evan's (1986) claims. It was found that road safety changes do affect accidents, most often in a positive manner; with the average rate of accidents per billion hours collectively driven by Americans on rural roads steadily decreasing over a 60-year period, as safety protocols became more stringent and motor vehicles became more crash resistant (Evans, 1986). However, the assertation that the correlation between improved safety measures and improved accident rates disproves the validity of RHT as a mechanism hingers on underlying assumptions about the interactions between safety and risk taking which may not necessarily be true.

Evans (1986) asserts that improvements in accident rates in conjunction with new safety legislature would indicate that RHT is invalid. However, this proposition assumes that the actions taken by individuals to compensate for implemented safety measures, will have real world ramifications which are directly proportional to the positive influence of the safety measure which facilitated the change in the first place. That is to say, the efficacy safety of measures, such as air bags, traction control and cruise control, may supersede the negative impact of the increased risk-taking behaviour their implementation may encourage. Take for example an individual who is driving more rapidly because they know their vehicle has traction control. They may be taking more risks in their driving, but the minute corrections made by the vehicles on board computer may compensate for this additional risk enough that the driver does not lose control where they previously would have. This debunking of RHT also assumes that risk taking behaviour is on a functionally infinite spectrum, in which risks can continue indefinitely without limitations of functionality or social constructs interceding. This is not the case; regardless of the safety measures in place there is always going to be an upper limit to what risks can be taken to respond to these measures before a behaviour loses functionality and social acceptability. For example, one can only take so many risks whilst driving a car before they have their license taken from them or in the extreme, they cease to be able to drive from point a to point b effectively. In essence; alterations in risk taking made by the individual only modify their *perceived* level of risk, not their material level of risk. With this rationale in mind, despite the contention surrounding its validity as the primary mechanism underpinning risk taking behaviour, RHT is used as the theoretical basis of the present experiment. This is primarily because the analysis of risk taking behaviour is, by its very nature extremely difficult to carry out and research, and often not economically viable to implement on a large scale (Janssen & Tenkink, 1988). This is because risk based situations are incredibly complex, and rarely attributed to one individual occurrence or circumstance.

Moreover, it is difficult to measure an individual's or group's perception of risk in the context of risk based decision making as it is variable and often not actively perceived; instead risk analysis often occurs on a subconscious level. To harken back to the race track analogy, an individual who is driving more dangerously because of their PPE is unlikely to be actively analysing the situation and proactively taking more risks. Instead the process is a more subversive, occurring instinctively and across numerous levels of consciousness (Wilde, 1982). This in turn makes it incredibly difficult to quantify any changes to the perception of risk, especially on a wider social scale (Janssen & Tenkink, 1988). Further, it is almost impossible to measure the prevalence of near misses or situations in which safety precautions have prevented an accident, as they are defined by the absence of an occurrence (Janssen & Tenkink, 1988). There is also the issue of ethical restrictions surrounding exposing one pool of participants to risk, when the control group is provided with safety precautions which makes examining the mechanism underlying risk taking behaviour particularly problematic (Janssen & Tenkink, 1988). In lieu of this the present experiment will move past the dissention surrounding how to categorise risk taking behaviour, and instead examine a means of moderating the behaviour, regardless of the mechanisms motivating it.

6. Developing the Present Experiment

6a. Selecting a Manipulation for the Independent Variable

The prevailing theme of risk based intervention and research is that perception of an environment is a pivotal part of how risk based decisions are made (Zuckerman& Kuhlman, 2000; Wilde, 1982; Weber et al., 2002). In particular, with RHT as a contextual framework for viewing risk taking, it stands to reason that manipulating an individual's perception of the levels of risk could reduce risk taking behaviour without modifying other behaviours or circumstances surrounding an activity or behaviour. Historically, signs and warning labels are widely utilised means of behavioural intervention and risk reduction (Van Houten & Retting, 2013; Otsubo, 1988). They are utilised in almost every scenario in which risk is trying to be diminished or compliance increased; from road signs, to slippery-when-wet signs, to anti-smoking labels, the consumer is constantly inundated with signs and labels seeking increased compliance (Otsubo, 1988). Research into the efficacy of signage in preventing unwanted risk is extensive, but primarily focused on participant compliance with instructions given by signs and labels (Van Houten & Retting, 2013; Hammond et al., 2005; Strahan et al., 2002), rather than the effect a warning label may have on an individual's perception of a situations risk levels. However, research into the efficacy of signs and labels does indicate that there is a correlation between the use of signage and increased compliance (Hammond et al., 2005). Take for example the work of Van Houten & Retting (2013), which examined the efficacy of large, mobile LED warning signs at three intersections. The risk mitigating capacity of the sign was measured in terms of the number of vehicles prompted to come to a complete stop at the intersections, when compared to the same intersections without the signs. The sign utilised by Van Houten & Retting (2013) took the form of a large pair of animated eyes looking from left to right before the intersection. This sign was used in addition to normal road stop signs. It was found that there was a statistically significant correlation between usage of the attention-grabbing sign and an increase in vehicles coming to a full stop at all three intersections (Van Houten & Retting, 2013). Moreover, it was found that there was a reduction in "conflicts" in the intersection; conflicts being the meeting of vehicles in the intersection during which one or both drivers had to take evasive action to avoid a crash. This finding is of particular interest as it indicates that the presence of the sign and the salience of the sign in the driver's mind may influence the behaviour of drivers who were violating road rules or behaving dangerously as well as individuals in whom the sign elicited complete compliance. Moreover, as previously mentioned. existing research and particularly RHT, suggests that risk taking behaviour and perception of risk are intrinsically linked. As such, an intervention which has been linked to a reduction in risk taking as a whole could be viewed as having some level of influence over an individual's perception of risk in a given situation. Operating under this premise, a small warning label attached to the harness of participants in the active participant pool was used as the primary manipulation, and independent variable in this experiment (see appendix 1a). This label read "This harness is intended to protect the user from serious injury or harm, however the risk of serious injury or harm is not eliminated by use of the harness". This warning was designed to be factual and to the point without eliciting a strong emotional response; as the intent of the label is to increase the salience of the safety equipment limitations in order to moderate their risk-taking behaviour, rather than to elicit a fear or anxiety response in the individuals.

6b. Selecting a Scenario

Sports are a pervasive aspect of day to day life for many people. They are also a practical setting in which safety equipment has a tangible and quantifiable benefit for the general public. Surveys and observational studies of high risk sports have found that safety equipment does have an influence on player behaviour and their perceptions of how they behave (Hildebrandt et al., 2011). Take for example winter sports, snow-boarding and skiing, which are notoriously dangerous, with risk based trade off and decisions being made constantly (Ruedl et al., 2009). Research into describing risk behaviour has produced varied and inconclusive results. Research by Ruedl et al, (2013) stated that over two thirds of skiers' self-report taking more risks when wearing a helmet. However, when 2000 injured skiers were surveyed, helmet use and self-reported risk taking did not appear to have a significant causal link to injury (Ruedl et al., 2013). To complicate the equation, research by Shealy et al, (2005) found that helmeted skiers were recorded going at much higher speeds than nonhelmeted skiers at a statistically significant level, but once again this did not have an influence on injury rates. Both studies, however reported that the way subjects perceived the helmet as influencing their behaviour was significant in determining how they behaved, or at least how they perceived their behaviour. That is to say in the research performed by both Ruedl et al, (2013) and Shealy (2005), participants reported and displayed higher risk taking when wearing safety equipment. This indicates their perceptions of appropriate behaviour during the activity were altered even though in both instances the helmets were not recorded to have any statistically significant influence on injury rate; this is particularly interesting when you consider that helmets protect only a very small area of the body, and as such one might expect increased risk taking to result in a rise in injuries in other parts of the body This is something which has been found to extend to other high risk sports such as rock climbing. Research by David Limb into incidents of injury in rock climbing facilities found no statistically significant interaction between the quality of safety equipment and the incidence of injury (Limb, 1995). Instead Limb found that where safety equipment was aged or inferior in quality, climbers made allowances in their climbing styles and thus avoided an increase in injuries proportional to the decrease in quality of the equipment (Limb, 1995). This finding is in line with the model presented by RHT and highlights the fact that when a risk is tangible and immediate, safety equipment appears to have an influence on behaviour.

The above research, however, is primarily observational. It provides insight into how risk taking behaviour is expressed, rather than how it might be manipulated. Safety equipment indeed does appear to influence risk taking behaviour; whether that is when it is omitted due to the perceived levels of risk, as were the findings of Ganczak and Szych (2007), or when it appears to have an influence on athlete’s perceptions of risk, and in turn what risks they are willing to take as found by Ruedl et al., (2013). However, it is yet unclear how the importance of safety equipment in risk based decision making might be used to mitigate risk taking. As such, the current experiment took the activity of rock-climbing (as simulated on a climbing wall), a novel event with tangible and realistic ramifications, and examined the extent to which the salience of safety equipment limitations moderated participant's risk taking behaviour (See appendix 1b). The present experiment built on the observational experiments of the likes of Ruedl et al. (2013), and measured risk taking behaviour as it was displayed in the experiment; but also added in the experimental factor of manipulating the salience of the limitations of the safety equipment. Further, the experiment also measured the extent to which the salience of safety equipment limitations affected the perceived enjoyableness of the activity by participants.

6c. Selecting a Measure of Enjoyment

One of the primary concerns for the present experiment was that participants would report a higher level of enjoyment than genuinely experienced if asked overtly about the activity after participating. As such, an indirect means of measuring enjoyment was selected, based on a survey of leisure activity enjoyment designed by Stevens et al., (2000). This survey was designed with the intent of examining how individuals enjoy both fitness based physical activity and leisure activity. Titled The Groningen Enjoyment Questionnaire (TGEQ) this questionnaire was found to be a statistically valid means of measuring participant enjoyment in a generalisable sense (Stevens et al., 2000). This questionnaire in particular was selected as a base for the present experiment's questionnaire as it provided an indirect means of gauging the effect of condition on the participant's over all attitudes towards physical activities, whilst avoiding the potential response bias posed by participants potentially inflating their enjoyment of the activity so as not to seem ungrateful. The original TGEQ was modified to remove questions which did not apply to the present experiment conditions. This additional variable was included because regardless of the effectiveness of an intervention, as stated by Janssen and Tenkink (1988), fiscal viability is a considerable limiting factor when it comes to implementing risk mitigating interventions on a societal scale. An examination of the effect of this particular intervention on the perceived enjoyableness of the activity provided for some important context surrounding its commercial applications and economic viability.

7. Summary

Unwanted risk taking behaviour is a multifaceted issue which pervades almost every aspect of day to day life (Reason, 1997). Moreover, the toll accidents resulting from unwanted risk taking behaviour take on society is massive (ACC,2015). Existing measures for preventing unwanted risk behaviour tend to be focused on manager involvement (McFadden, 2009) and strict legislative measures (Health and Safety at Work Act, 2015). In turn, these measures are enforced using often extremely harsh financial penalties (WorkSafe New Zealand, 2018). Whilst spreading responsibility down the supply chain has been proven to be an effective means of risk prevention in an industrial setting (Simard & Marchand, 1994), this does little to assist in risk prevention in public sectors and wilful violations of existing safety measures. Instead of pursuing more traditional means of risk intervention, the present experiment utilised RHT as a behavioural context for examining the means through which individuals attribute value when constructing their perceptions of a potentially dangerous situation in the first place. A small warning label was selected as the primary means of modifying the salience of the limitations of the safety equipment worn by participants with the aim of influencing their inherent perceived levels of risk.

In doing so the boundaries of the influence of safety equipment on perception were explored both, in terms of enjoyability and in the context of moderating the risk taking behaviours associated with RHT. This was with the wider goal of potentially establishing a cost effective, non-invasive, and efficient means of minimising unwanted risk taking behaviour, and by extension the economic and social toll it has on the population. It was hypothesised that increasing the salience of the limitations of safety equipment would decrease risk taking behaviour in participants. It was further hypothesised that the salience of the limitations of safety equipment would not negatively affect participant perceptions of activity enjoyability.

Method

Participants

In the present experiment (n= 46) participants were recruited from the general student body of Canterbury University. All participants were over the age of 18. The gender spread of the participant pool was 17:29 in favour of females. Participants were recruited through a variety of means; flyers posted up around the university, posts on digital student notice boards and flyers handed to the student body in communal areas (See Appendix 3a). In the interests of obtaining a diverse participant pool the restrictions for participation were kept minimal. The recruitment material included the provisions that prospective participants had to be over the age of 18, able to climb safely and comfortably without exacerbating any pre-existing issues or conditions, and a university student. Skill levels in climbing and other physical activities covered a broad spectrum and no specific level of climbing skill was targeted. Care was taken to avoid leaving flyers in locations which might recruit a specific demographic more than others, such as outside the university Gymnasium or climbing club meetings. Also included in the recruitment material was advertisement of the incentive, in this case a $10 voucher for use at a local shopping centre. An email for the participants to express their interest to was listed on the flyers and public postings. Participants were recruited from across all faculties in the university and flyers were placed in every main building to assure that all departments were given equal exposure to the recruitment process.

Participants were randomly assigned to the two conditions using a randomised number generation process. Participant allocation was balanced across the two participant pools by taking a sample of participants and re allocating them at random until they were evenly distributed between the two pools.

Apparatus

The experiment was carried out in the University of Canterbury Recreational Centre rock climbing room (See Appendix 1b). The climbing room was fully enclosed with a wide range of rock holds for different skill levels and lockable door to prevent external distractions. During the experimental process the room was booked, and locked so that only the experimenter and the participant were present. Participants were provided with a hard copy consent form (See Appendix 2b) and experimental briefing (See Appendix 2c) upon arrival. All personal belongings were stored in the centre of the room and away from the climbing wall. Two harnesses were laid out on the floor of the climbing room before participants arrived (See Appendix 1c) one in a size large and one in a size small. Depending on the size of the participant one of the options would be removed by the experimenter whilst the participant was signing their consent form leaving only one option remaining. The climbing equipment itself consisted of 30 metres of climbing rope, a gri-gri manual belaying system and a carabiner. Both the carabiner and the gri-gri were attached to the researcher's own harness in order to secure the belaying rig. The participants were tied onto the harness using a figure-8-knot redoubled through itself. The experiment utilised a pre-existing, black, perforated tape line three metres up the climbing wall to indicate where participants should complete their climb.

When the two climbing sessions were completed participants were provided with a hard copy of the questionnaire to complete (See Appendix 2a). By removing question five of the original questionnaire which read “I find class really enjoyable”, the questionnaire was adapted to fit the climbing scenario. Each question was ranked in applicability to the individual participant using a Likert scale form 1-10. 1 was selected as applying to them “not at all” whilst 10 represented applying to them “completely”. Once this was completed the participants were offered their reimbursement in the form of a $10 voucher for a local shopping centre.

Procedure

Participants signed up for the present experiment by emailing their interest through to an email provided on the flyers hung up around the university. At this point in time they were provided with a consent form to review and asked to select a 20-minute time slot. Once a participation time was established participants were sent the following instructions “Thank you very much for your participation. Please meet me in the foyer of the recreational centre at __ o’clock. Please make sure you are wearing active-wear appropriate for climbing, that you have your hair tied up if it is below your jaw, and that you are a member of the University of Canterbury gym.” When participants arrived, they were greeted by the experiment supervisor and taken to the rock climbing room. The researcher was always already wearing their own harness to greet participants, both to make identifying the researcher easier for the participants and to assure that each individual’s exposure to safety equipment was the same across all data points. The gri-gri and carabiner used by the researcher was hung off their harness at the hip when not in use, including when greeting the subjects. Once in the climbing room the door was locked and the participants were given an opportunity to put their belongings in the centre of the room and to either secure or take off any loose-fitting apparel (such as hooded sweatshirts with draw strings or jewellery) that might get stuck in the equipment. Whilst the individual was doing so, the experimenter asked “Is it alright with you if I record the audio for this session? There will be no personally identifying features on the tape". Once the participant agreed the recording device was turned on to record proceedings. At this point participants were provided with a hard copy of the consent form to sign as well as an experimental briefing detailing what they were to do during the experiment. The briefing went through what was expected on a step by step basis, the briefing did not vary between conditions. Participants were then instructed to "please step into the harness" by the experimenter. This is the only point at which the two participant pools diverged. In the control condition, participants could simply step into the harness, pull it up and tighten it to suit their needs. In the experimental condition (the increased salience condition), participants were forced to remove a luggage tag from the harness which was fastened so as to secure the two leg holes together and make putting it on without acknowledging the label impossible. The participant was not instructed what to do with the label, however the majority of the time the participant would hand it over to the experimenter to hold onto without instruction. In all instances the participants read the entirety of the label of their own volition. In the event the participant had any questions about the tag answers were kept succinct and as neutral as possible, all answers were kept as close to the answer "It's there to make you aware of the limitations of your safety equipment" as possible. Following this point the two conditions return to being identical. The participants and the experimenter stepped up onto the safety mats and the rope. The researcher then asked the individual to stick their thumbs into the waist band of their harness and push downwards to assure it was secured sufficiently. If it was not the participant was instructed to "please tighten that more". Care was taken to assure that the participants did not receive any indication of why they needed to tighten the harness so as to avoid modifying individual perceptions of the harness beyond what was done by the luggage tag itself if present. From here, the experimenter took the loose end of the rope and advised the participant "I'm going to show you what I need you to do on your own harness" and fed the end of the rope up through the bottom most loop of their harness, and up through the top. The rope was then removed and passed to the participant for them to repeat the motion. This being done, the researcher would then advise “I’m going to tie you in using a double figure eight knot.” Once the knot was refastened on itself the participant was then advised “you safety check a double figure eight knot my making sure there are ten pieces of rope on each side” the experimenter then counted out loud to indicate all 10 pieces. This was done in compliance with rock climbing safety procedures which dictate that both the belayer and the climber must actively acknowledge that the knot has been checked. The researcher then advised that they were going to clip themselves in and secured themselves to the “dead-end” of the rope with the gri-gri and carabiner. Once again, the researcher verbally confirmed that the participant had seen the rope was fastened and the carabiner was locked.

The participant was expected to begin the climbing experiment of their own volition, however if they failed to do so or looked to the researcher for direction step three of the briefing was repeated to them verbally. Once the subject indicated that they were ready they were given a countdown of “3,2,1, Go”. Their climbing time was taken from the end of the word “go”. During the climb any slip or mistake was noted with a spoken “one” by the researcher. A mistake was defined as a participant missing a foot or hand hold, reaching for a hold not making contact, a hand or foot losing contact with a hold unintentionally, a limb being extended towards a hold and then retracted or when a participant fell from the wall partially or completely. It was often found that participants looked to the researched for reassurance when they did make an error. In this instance they were instructed to “please continue”. Once the participant’s shoulders crested the perforated black line they gave a verbal indication of “done”. They were then instructed “bring your legs out parallel to the floor, sit back in your harness and I’ll walk you down.” The Participant was then belayed down. If it was their first repetition they were asked to repeat the task, if not they were untied and asked to step out of their harness. The participants were then given the questionnaire to fill out. Once the questionnaire was completed they were given their compensation for participating and thanked for their time. They also signed a form confirming that they had received their compensation in the form of a voucher. It was at a later point that the researcher would review the audio files and record slips and errors, and time to completion. This was retained on a spreadsheet and then the audio file was deleted. Each participant's responses to the questionnaire was coded with date and time in a separate sheet to be easily matched against participant performance.

Results

The time to complete each of the two climbs, as well as the number of slips or errors within each respective climb, was recorded for each participant. Following this the average of each data set was taken and used for subsequent analyses. A one-way analysis of variance was selected as the primary means of analysis for this experiment. This analysis was selected as the key focus of the present experiment was on whether there was a statistically significant difference between the means of the control group and the high salience group, with regards to error rate and time to complete the climbs, as well as the effect of the experimental manipulation on perceived enjoyableness of the activity.

Examination of distributions of the dependent variables averages across both conditions were used to examine for outliers. No participants with results three standard deviations from the mean were found for either condition, nor either of the metrics of risk. With this in mind no data points obtained from the research were excluded.

The first result examined was the effect of increased salience on average time for climb completion. The control group presented with a mean average time of 10.68 seconds whilst the high salience pool presented a mean average time of 14.67 (see Table 1). The longer time to complete the climbing task displayed by the high salience group when compared to the control trends towards what was hypothesised, this being that increasing the salience of the limitations of safety equipment would moderate risk taking behaviour and increase completion times (see Figure 2). To determine if this difference between the means was statistically signification a one-way ANOVA was carried out. The results of the one-way ANOVA confirmed that there was a statistically significant difference between the two means at the $p<.05$ level (F [1,44] = 4.944, p = .031, $\eta_p^2 = .101$). Moreover, the high effect size ($\eta_p^2 = .101$) indicates that a considerable portion of the variance in average time for completion was accounted for by the increase in salience.

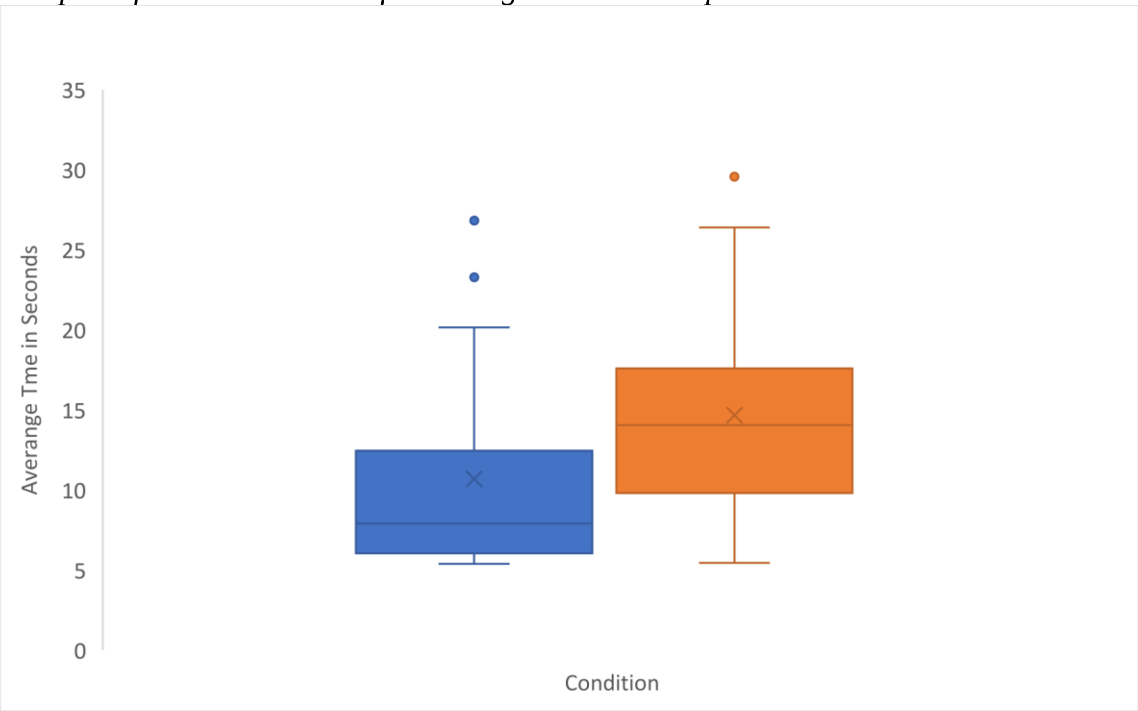
Table 1

One-way ANOVA of Average Time to Complete by Participant by Condition

Condition	*M*	*SD*	*MinTime*	*MaxTime*
Control	10.68	5.99	5.38	26.82
High-Salience	14.67	6.17	5.45	29.57

Figure 1

Box-plot of Condition Means for Average Time to Complete



Following this, the average error rate across the two trials was compared for each condition. Following the trend displayed in analysis of the average time data, the control group behaved in a manner predicted by the hypothesis; with the control presenting a mean average error rate of 2.76 compared to a result of 1.41 for the high salience group (see Table 2). These results indicated that once again the control group displayed a greater inclination towards risk taking behaviour than the high salience group. A one-way ANOVA indicated that the difference between the two-means was statistical different at a p<.05 level (F [1,44] = 6.577, p = .014, η_p^2 = .130). As was the case with the average time data, the high effect size indicates that a considerable portion of variance in average error was accounted for by the increase in salience.

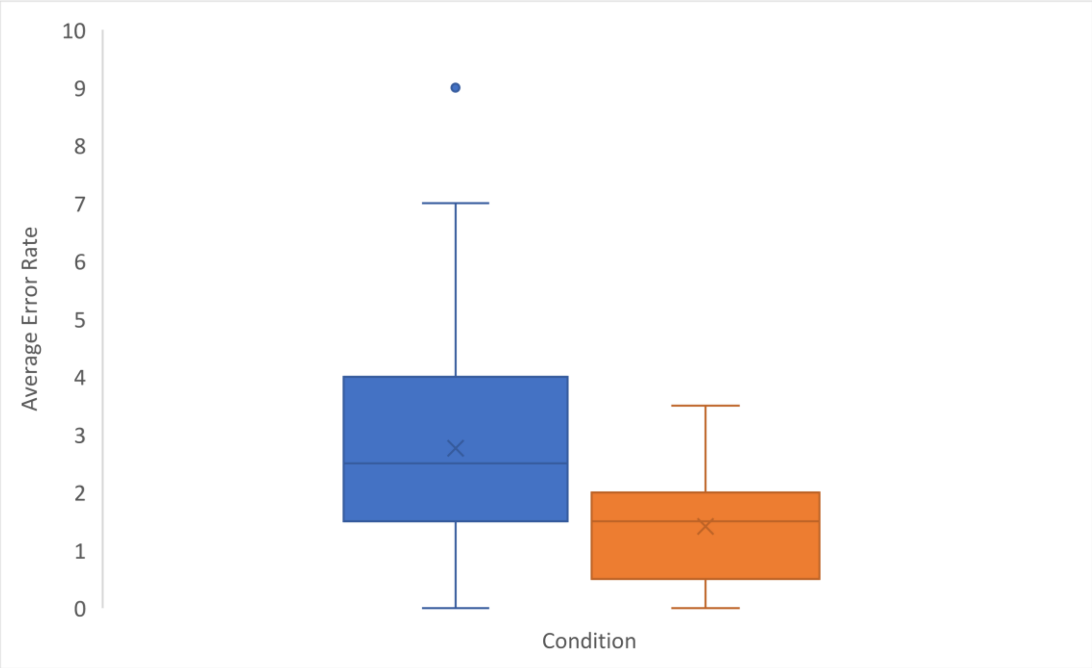
Table 2

One-way ANOVA of Average Error Rate by Participant by Condition

Condition	*M*	*SD*	*MinError*	*MaxError*
Control	2.76	2.31	0	9
High-Salience	1.41	1.00	0	3.5

Figure 2

Box-plot of Condition Means for Average Error Rate Per Participant



Finally, the last facet of the analysis was whether the experimental manipulation (independent variable) had any effect on perceived enjoyableness of the leisure activity. This time the mean answer for each question each question was taken for each condition and a one-way ANOVA carried out to compare the means. The salience of the safety equipment limitations did not have a statistically significant effect on the answers to any of the questions. Also of interest was the fact that the answers to these questions were very homogenous and tightly clustered around the upper end of the Likert scale (see Table 3).

Table 3

One-way ANOVA of Average Question Answer by Question by Condition

	Condition	M	SD	MinAns	MaxAns
Q1	Control	8.13	1.29	5	10
	HS	7.65	0.982	6	9
Q2	Control	8.3	1.46	4	10
	HS	8.43	0.992	6	10
Q3	Control	7.96	1.261	5	10
	HS	7.96	1.065	6	9
Q4	Control	8.3	1.02	5	10
	HS	8	0.905	6	9
Q5	Control	8	1.087	5	9
	HS	8.09	1.125	5	9
Q6	Control	7.87	1.254	4	9
	HS	7.87	1.1	5	9
Q7	Control	7.74	1.176	4	9
	HS	7.87	0.869	6	9
Q8	Control	8.04	1.065	5	10
	HS	7.91	0.793	6	9
Q9	Control	7.96	1.107	5	10
	HS	7.83	1.029	5	9

Discussion

Based on the analysis of the behaviour of the 46 participants in the present experiment, it would appear that there is a statistically significant relationship the increase in the salience of the limitations of safety equipment, and a decrease in the risk taking behaviour of rock climbers with a confidence of $p < .05$ (risk taking behaviour was taken as being expressed through both the rapidity with which each climb was completed and the number of errors on the part of the participant). Further, it was found that there was no statistically significant effect of the salience of the limitations of the safety equipment on the perceived enjoyableness of the experiment. This was measured indirectly through a generalised leisure activity questionnaire. These results confirm both hypotheses for this experiment; these being that increasing the salience of the limitations of safety equipment would decrease risk taking behaviour in the participants, and that the salience of the limitations of safety equipment would not negatively affect participant perceptions of activity enjoyability. Moreover, analysis of the effect size of both metrics of risk indicates that a large portion of the variance was accounted for by the experimental manipulation.

These results are promising and certainly add credence to the assertion that modifying an individual's perceptions of the level of risk in any given situation may in turn reduce risk taking behaviour. However, despite the statistical significance of the present research, there is still much to be considered and examined before any concrete resolutions can be established.

As previously stated, participants were recruited from the general student body using signage, electronic notices and flyers. Whilst care was taken to approach the student body as broadly as possible there is still the potential for a self-selection bias to be present in the experiment. This is because rock climbing is a relatively physically demanding activity. When one considers that all participants were made aware of the nature of the experiment before agreeing to participate, a consideration must be made regarding whether this influenced the type of individual whom was inclined to respond. The knowledge that the individuals would be expected to climb the wall as quickly and efficiently as possible, and potentially be judged on their performance may have made individuals who are more athletically gifted, or more skilled at rock climbing more inclined to participant than individuals whom are less adept. This possible self-selection bias does not necessarily discredit or compromise the statistical and scientific significance of the present experiment's findings. However, it does potentially narrow the generalizability of the findings.

Of particular note is that fact that the way in which experts process and assess a behaviour are not necessarily the same as how a novice processes a scenario (Newell, 1991). Take for example closed and open loop behaviours. A closed loop behaviour with which an individual is not familiar and thus requires more of their mental faculties to carry out. This in turn reduces the number of external stimuli the individual is able to process whilst carrying out said activity (Newell, 1991). As an individual's skill levels rise, they are able to dedicate less conscious processing to the activity which makes room for other stimuli and activities (Newell, 1991). For example, a learner driver will have to focus on changing gears, breaking, accelerating and what is happening on the road, as well as consciously synchronising all those behaviours, and thus may not be particularly able to hold a conversation whilst driving. However, the same individual when well-practiced may converse, read a GPS or think about their day whilst driving quite comfortably. If the participant pool for this experiment were more familiar with climbing equipment and climbing in general then it could potentially confound the findings in two ways. Firstly, there is the possibility that harnesses and belaying equipment have become familiar to the experienced participants, this may mean that reminding them of the limitations of this is more jarring and thus more acutely salient due to the break from familiarity. Inversely, a less experienced individual may view the situation as being more inherently dangerous and the PPEs as being less infallible due to their lack of experience. This could mean that if indeed more athletic individuals were disproportionately represented in the participant pool, the effect of highlighting the salience of the limitations of the safety equipment is be more pronounced than in a less homogenous group. The second issue that a skilled participant pool would pose is that if the activity were an open loop behaviour, that may leave participants with more cognitive faculties spare to consider the potential ramifications of falling once they are highlighted. To return to the learner driver metaphor, if a learner driver is heavily focused on not stalling their vehicle and not crashing, they may be less able to readily absorb information about the potential harm an airbag could do in event of a crash. An experienced driver, however, who is capable of driving and thinking on abstract issues at the same time may be better able to wrap their heads around the weight of the warning given to them and react accordingly.

The concern that the participant pool was a disproportionately athletic one is supported by the overwhelmingly positive responses to the leisure activity enjoyment questionnaire. The mode response on the Likert scale for questions one to four was 9/10, and 8/10 for questions five through nine. Such positive responses surrounding sport and leisure indicates that the participants in the present experiment were athletically inclined, at least to some extent.

With these two confounds in mind one avenue for future research would be to include questions in the questionnaire which measure both the skill and experience level of the participant in the given activity. Because whilst the findings of the present experiment are by no means invalidated by this possible confound, if the influence of the manipulation is exaggerated amongst experienced or expert individuals, the scope with which this intervention can be applied may be limited. This issue of a homogeneity of skill could also be addressed by a multifaceted recruitment process in which three versions of recruitment material (such as flyers or advertisements) are released. Each of the three recruitment material types could be directed at a different climbing skill level such as novice, intermediate and experienced. Participants of these varying skill levels could then in turn be either randomly distributed between the two conditions, or, each skill level could be retained in isolation, with novice, intermediate and high representing levels within each of the two conditions.

Another potential limitation within the present experiment, is that all the participants were students participating in what is generally thought to be an enjoyable activity. As discussed by the likes of Weber et al., (2012), and Dingsdag et al., (2008), often a huge contributing factor to the development of risk perception is a time-spent-to-value-gained trade off. That is to say, in real world applications individuals will often violate health and safety protocols, or take unwanted risks because the individual perceives the level of risk to be low enough to justify the violation in return for a high reward; be it greater efficiency, higher profit or social approval. In the present experiment there was no external incentive which might drive participants to disregard the effect that increasing the salience of the PPE limitations might have had. Once again, this is an issue of generalisability; if a moderator of a risk-taking behaviour only ameliorates a behaviour when there are no external incentives pushing a participant to disregard the measure, then the practicality of the measure in real world settings would be limited.

To address this, incentivisation, pushing individuals to perform to the limits of their ability would better emulate real world settings in which external factors such as time pressure incentivise risk. For example, if participants were to be offered a baseline cash incentive, and an additional dollar for every second under a set time frame they achieved, the validity of a warning label as a mean of perception modification and risk intervention could be better measured for application in a real-world setting.

The above two potential confounds also touch on a wider issue which pervades research into risk taking as a whole; no risk-taking decision happens in a vacuum. There is a plethora of environmental factors which go into creating an individual's perception of the risk involved in a given scenario. In reducing the variables in a research environment in order to isolate a behaviour, authenticity and generalizability to real world applications is lost or at least diluted. To contextualise this statement in terms of the present experiment, it can be concluded that when individual skill levels, individual proclivity towards risk taking and an increase in salience of the limitations of safety equipment appears to reduce risk taking behaviour. However, it is as yet unclear how well this intervention would apply in a real-world setting. This observation stems from existing issues in risk intervention and prevention measures. As highlighted above, present interventions such as signage (with the intention of gaining compliance rather than manipulation perception) (Van Houten & Retting, 2001), safety responsibility proliferation throughout a managerial chain (McFadden et al, 2009), and the development of pro-safety environments (Cavazza & Serpe, 2009) have been shown to be effective. However, it is when external, real world pressures are added into the equation that violations can occur. This is because these external pressures, be they social, financial, or efficiency add value to the prospect of taking a risk during the decision-making process. As such, a prudent avenue for future research could be to examine the validity of increasing the salience of the limitations of safety equipment across a sequence of experiments; each experiment in turn exploring this behavioural intervention whilst participants are exposed to one of the above external pressures. Take for example the present experiment, but in addition participants were exposed to social pressures, either in the form of participating in a peer group, or by reading vignettes which depict physically adept individuals as gaining social approval. Another example, this time using efficiency pressures as the primary external pressure, would be giving participants a time limit for completion of each climb. This time pressure would better emulate real world settings, in particular industrial settings such as construction, in which completing a potentially hazardous task quickly is highly incentivised (Tam et al., 2004). By addressing each type of external pressure in isolation the generalisability of the behavioural intervention could be reviewed in an environment closer to that experience in real life settings but without exposing participants to so many variables that a behaviour becomes difficult to isolate and measure.

Risk is unavoidable. Risk is also not necessarily a bad thing; there is risk associated with getting in your car to go to work in the morning but also value to be gained from doing so. Be that as it may, when risk taking behaviour turns into unwanted risk-taking behaviour the toll on society can be huge. Economically, workplace health and safety violations affect businesses massively, both in terms of financial impact and hours lost (Lanoie & Trottier, 1998). Socially, with 125,997 individuals killed or severely injured in accidents across a 12-year period (ACC, 2015) the individual impact of unwanted risk-taking behaviour is huge, and that is only considering the consequences of direct risk-taking behaviour. When more indirect means of unwanted risk taking, such as drug abuse, unsafe sexual practices, problem gambling and crime are factored into the mix, the problem becomes greater still.

The current environment surrounding both health and safety and risk prevention is fraught with contention; with both the general public and workers within industries generally resisting, if not outright resenting the implementation of safety protocols (Cavazza & Serpe, 2009). To tackle this pervasive social issue a broad range of tactics are used across a scope of environments which are even broader still. However, as a whole, these interventions tend to be heavily centred around labelling (Hammond, 2006), and design (Reason, 1997) in the private sector. The industrial field follows a similar trend, with the addition of comprehensive health and safety legislature (Health & Safety at Work Act, 2015), the promotion of pro-safety work environments (Burke et al., 2006) and proliferation of responsibility for safety down the supply chain (McFadden et al., 2009). In industrial settings, deviations from legislative boundaries are met with extremely harsh financial penalties and prosecution. Research by the likes of Cavazza and Serpe (2000), McFadden et al., 2009 and Flin (2003) show that these measures against risk taking are largely effective. However, with the ramifications of unwanted risk taking so pervasive, there is still clearly room for development in terms of risk interventions.

In Conclusion

The present experiment used the core concept of RHT (Wilde, 1982), this being that individuals will behave more or less dangerously depending on their perceived level of risk, as a baseline for developing a possible means of moderating risk-taking behaviour. It is concluded that the behavioural intervention of increasing the salience of the limitations of an individual's safety equipment was found to have a statistically significant moderating effect on both metrics of risk during the climbing task, these being time to completion and number of errors. Furthermore, it was found that there was no statistically significant effect of the experimental conditions on perceived enjoyableness of the activity by participants. This confirms both hypotheses in the present experiment; these being that increasing the salience of the limitations of safety equipment would decrease risk taking behaviour in participants, and that the salience of the limitations of safety equipment would not negatively affect participant perceptions of activity enjoyability. These findings hold promise and a possible direction for future research into moderating risk-taking behaviour towards a focus on modifying perception rather than discouraging non-compliance. However, there is still much work to be done into whether or not increasing the salience of safety equipment limitations through signage is a valid means of risk intervention in a broader, more complex real-world setting. In particular, two potential confounds were discussed as potential confounds in the present experiment. Firstly, due to the physical nature of the activity and the fact that the participants selected themselves for participation, there is the possibility that the participant pool of this experiment was disproportionately athletic when compared to the general population. This assertion is supported by the incredibly uniform responses to the enjoyability questionnaire, which showed all participants as ranking very highly in leisure and physical activity enjoyment. Secondly, there is a possible issue with generalisability, both in terms of the afore mentioned homogeneity, and because there were no real incentives encouraging non-compliance in the participants as there would be in a real-world setting. With this in mind it is suggested that future research could include a tri-pronged recruitment process, which directly targets novice, intermediate and skilled climbers. It is also put forward that a series of experiments, each exposing the participants to a different external risk, such as social or fiscal pressures, could better emulate a real-world environment and test the robustness of salience modification as a behavioural intervention.

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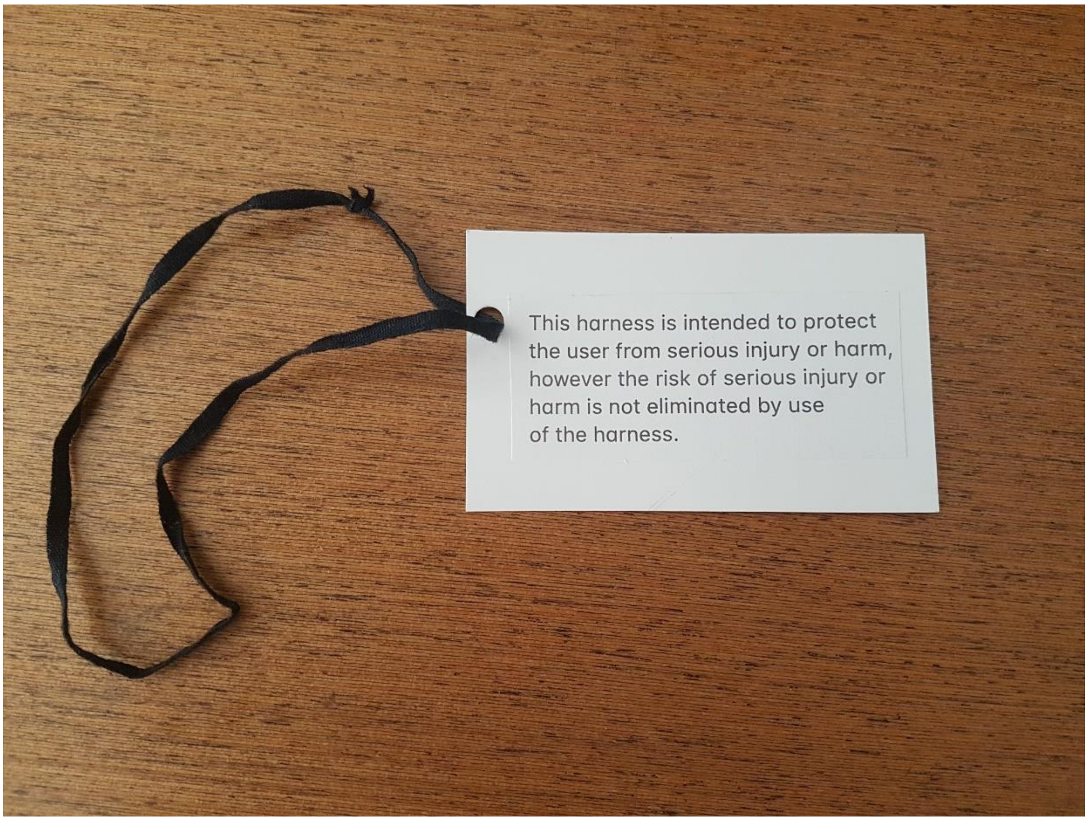
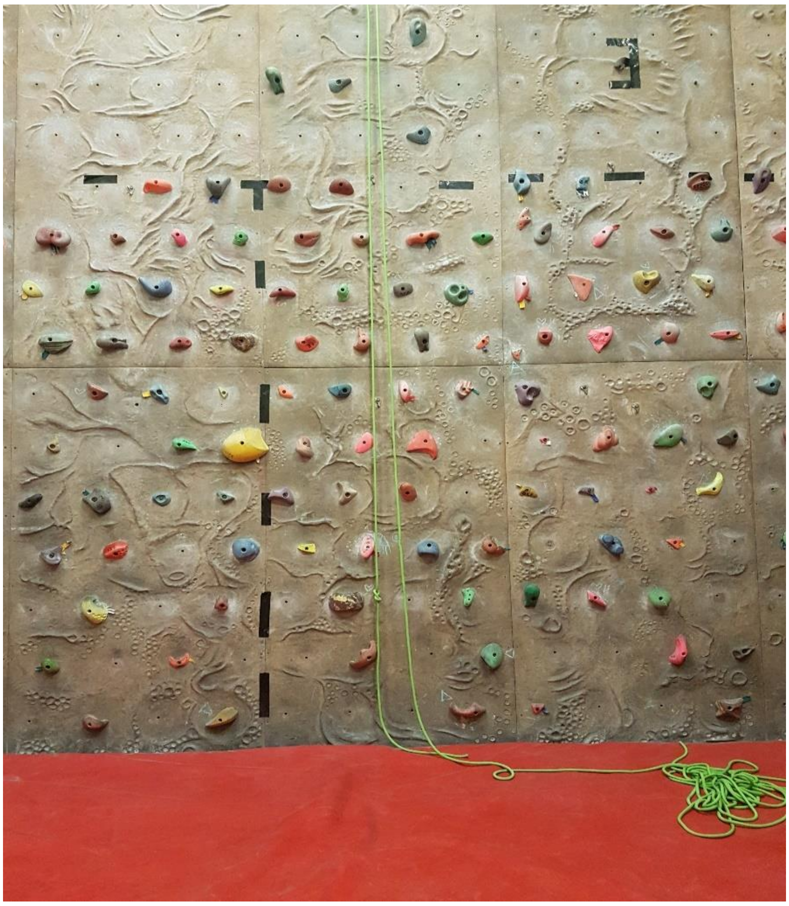
Appendix 1

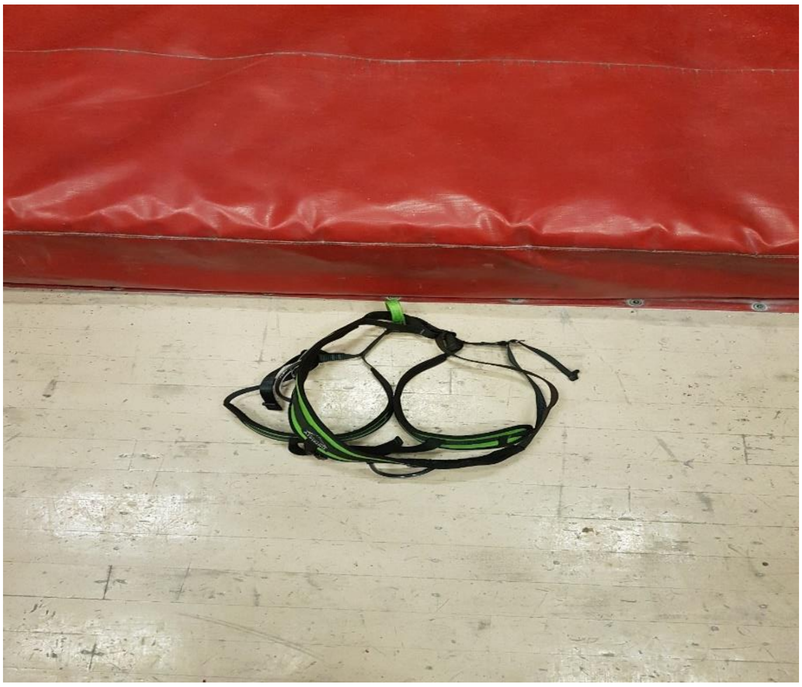
A) Label Used to Increase Safety Equipment Limitation Salience



B) University of Canterbury Recreational Centre Climbing Wall and Belaying Apparatus



C) Harness Laid Out on Floor for Participant



Appendix 2

A) Modified Example of the TGEQ

Questionnaire

Please rate the following statements on how well they apply to you with one being "not at all" and 10 being "completely". Circle the applicable number with the pen provided.
Gender (circle the one which applies): Female/Male

Questions
1. Doing leisure-time physical activities makes me feel good 1 2 3 4 5 6 7 8 9 10 2. I like being physically active 1 2 3 4 5 6 7 8 9 10 3. Doing leisure-time physical activities makes me feel energetic and alive 1 2 3 4 5 6 7 8 9 10 4. Doing leisure-time physical activities cheers me up 1 2 3 4 5 6 7 8 9 10 5. Doing leisure-time physical activities gives me satisfaction 1 2 3 4 5 6 7 8 9 10 6. I often give it all I have in leisure-time activities 1 2 3 4 5 6 7 8 9 10 7. I often forget the time when I'm doing leisure-time physical activities 1 2 3 4 5 6 7 8 9 10 8. I feel relaxed when I'm doing leisure-time physical activities 1 2 3 4 5 6 7 8 9 10 9. During leisure-time physical activity, I feel I can be myself 1 2 3 4 5 6 7 8 9 10

B) Consent Form Given to Participants Page 1

Department of Psychology
Email: aec70@uclive.ac.nz

Rock-Climbing Error Rates and Enjoyment When Under Time Constraints

The present experiment is part of a Master's thesis project which aims to examine the performance of participants on a dexterity task with varying levels of safety measures. Performance will be ranked on both the speed and the accuracy with which the task are completed.
If you choose to take part in this study, your involvement in this project will be to climb up a rock climbing wall whilst wearing a harness. You will be asked to climb until your shoulders are above a blue line, three metres up the wall. You will be expected to complete this task twice. You will also be asked to fill out a brief questionnaire.

Participation is voluntary and you have the right to withdraw at any stage without penalty. You may ask for:
Your raw data to be returned to you or destroyed at any point. If you withdraw, I will remove information relating to you. However, once analysis of raw data starts in September it will become increasingly difficult to remove the influence of your data on the results. The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation: your identity will not be made public without your prior consent. To ensure anonymity and confidentiality, no identifying information will be taken from the participants.
Please indicate to the researcher on the consent form if you would like to receive a copy of the summary of results of the project.
The project is being carried out as a requirement for a Master's Thesis research project by Amy Cohen, contactable on aec70@uclive.ac.nz who is under the supervision of Christopher Burt. Christopher can be contacted at Christopher.burt@canterbury.ac.nz. He will be pleased to discuss any concerns you may have about participation in the project.
This project has been reviewed and approved by the University of Canterbury Human Ethics Committee, and participants should address any complaints to The Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).
If you agree to participate in the study, you are asked to complete the consent form and return the form to aec70@uclive.ac.nz.

C) Consent Form Given to Participants Page 2

Department of Psychology
Email: aec70@uclive.ac.nz

Rock-Climbing Error Rates and Enjoyment When Under Time Constraints

☐ I have been given a full explanation of this project and have had the opportunity to ask questions.

☐ I understand what is required of me if I agree to take part in the research.

☐ I understand that participation is voluntary and I may withdraw at any time without penalty.
Withdrawal of participation will also include the withdrawal of any information I have provided
should this remain practically achievable.

☐ I understand that any information or opinions I provide will be kept confidential to the researcher and her supervisor and that any published or reported results will not identify the participants.

☐ I understand that all data collected for the study will be kept in locked and secure facilities and/or in password protected electronic form and will be destroyed after five years.

☐ I understand the risks associated with taking part and how they will be managed.

☐ I understand that I am able to receive a report on the findings of the study by contacting the researcher at the conclusion of the project.

☐ I understand that I can contact the researcher Amy Cohen at aec70@uclive.ac.nz or supervisor
Christopher Burt at Christopher.burt@canterbury.ac.nz for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz)

☐ I would like a summary of the results of the project.

☐ By signing below, I agree to participate in this research project.

D) Experimental Briefing

Experimental Briefing

This experiment measures the time taken to climb to the black tape line on the climbing wall above. If you have any existing conditions or injuries which limit your mobility please inform the experiment supervisor now. If at any point you become uncomfortable or no longer wish to continue with the experiment, please say "I want to stop". Please read the following instructions carefully and if you have any questions ask before the experiment begins.

How to put on your harness and safety measures

To put on your harness, first lay out the harness on the floor of the climbing room. Make sure there are no twists or loops in the harness. Open up the leg holes and waist of the harness so that you can step into it. Step into the harness by putting your feet into the two leg holes, make sure the hip straps are not in the way. Pull the harness up and fasten it around your hips by pulling the straps tight. Check that it is tight enough by pulling down on the harness. It should star up around your hips. Next, tighten the leg straps enough that they feel firm, but you can still move and flex comfortably. Once this is done, please inform the researcher so they can check your harness. Please climb within your comfort zone. If you feel any physical or emotional distress or discomfort at any time, please inform the researcher and stop climbing. Please do not purposefully jump off the wall without warning. Do not swing or kick out from the wall. Falling from the wall with excess force or impact may cause tenderness or bruising around the area of the harness.

Procedure

During this experiment you will be required to put on your own harness and climb up to the black tape line demarcated on the climbing wall above. Your experiment supervisor will check your harness before you begin your climb. The climb will be considered complete once your head passes the black line. Please do not intentionally jump off the wall without warning the researcher first. Please climb to the mark as quickly as possible.

1. Stand in front of the wall when you are ready to go.
2. When you are ready to begin **say "ready"** in a clear voice. The supervisor will then give you a count of "3, 2, 1, go". **Start the trial on go**.
3. From there, climb the wall as quickly and efficiently as possible. If you fall off the wall that will be counted as one climb completed. If this is the case, the researcher will lower you to the ground.
4. When you bring your shoulders level with the black tape say **"Done" in a loud, clear voice**. It is important that you are honest about when you complete each trial and do not say "done" early.
5. **Wait** until the researcher acknowledges your completion of the task. They will then say "you can let go". At this time you can let go of the wall and you will be lowered down.
6. If you have completed your first trial, please repeat steps 1-5.
7. When you are done with your second trial you may take off your harness. You will then be asked to fill out a brief questionnaire.

Appendix 3

A) Flyer/Recruitment Material

Free Rock-Climbing & a $10 Westfield-Card

Participants Required

Participants are needed for a Master's thesis experiment to be run in the University of Canterbury recreational centre. Participants will be required to give up approximately 20 minutes of their day in order to climb a rock-climbing wall and carry out a brief questionnaire.

Compensation in the form of a **$10 Westfield-Card** will also be given.

All participants must be University of Canterbury students, over the age of 18 and able to participate in rock-climbing safely and comfortably, without the risk of aggravating any existing conditions.

To enquire as to whether you are able to participate or book in please contact Amy Cohen at aec70@uclive.ac.nz.